

You gotta have HART...

Musings on this low-profile communications protocol



By Dick Caro

The most widely used digital data communications protocol in all of industrial automation is HART, supported by the HART Communication Foundation, Austin, TX, USA. According to ARC Advisory Group, HART outsells combined Foundation Fieldbus and Profibus-PA by a factor of more than 3:1 and is likely to continue this until 2007. Perhaps the seven-year lead of HART over Profibus-PA and a nine-year lead over Foundation Fieldbus H1 have something to do with it. On the other hand, price parity for HART with conventional analog process control transmitters has more to do with HART's popularity. Unquestionably, HART providing process control field devices with software adjustable range and zero adjustment with no premium over analog means that both suppliers and large process plants can effectively carry less inventory, since one HART instrument can be field adjusted to replace many analog devices. With no selling price premium, there is no reason to use older conventional analog instruments.

HART also offers a wealth of what the HART Communications Foundation calls "hidden data." Since all HART field devices have an on-board microprocessor, typically in the Intel 80C51 family, they contain a wealth of data for maintenance purposes. Data such as the current calibration range, any zero offsets, date of calibration, initials of the maintenance tech who did the calibration, etc. are common. Previously, this data was entered only via a handheld terminal used in the instrument shop, but most modern DCSs offer a direct HART interface effectively integrating HART data with the DCS and therefore with Asset Management software.

HART Remote Control Device Management System at Pemex

Modernisation of the CADEREYTA Refinery comprises more than 14500 field instruments using the HART protocol. Recently, Pemex Refining has established an aggressive Modernisation Master Plan for all their production facilities. The Modernisation Master Plan is a benefits analysis based study carried out by the Production Division in Pemex Refining for each of their Refineries. In such a plan, the basis for the modernization path to follow was defined in accordance with the safety requirements detected and the expected improvements in products quality, operation reliability, availability and productivity for

each of the Production Units.

One part of the Modernisation Master Plan is a thorough modernization and new construction of the CADEREYTA Refinery. It comprises a total need of altogether more than 14 500 field instruments using the HART protocol. ABB met the challenge to set up a sophisticated solution, capable of managing all field instruments concurrently from different locations, such as the Central Control room, using the HART Managing Clients, which are part of the entire HART Management Network System.

The HART (Highway Addressable Remote Transducer) protocol operates using the Frequency Shift Keying (FSK) principle, which is based on the Bell 202 communication standard. The digital signal is made up from two frequencies - 1200 Hz and 2200 Hz, representing bits 1 and 0 respectively.

In this project, it is necessary for the structure of a bus system to make the FSK signals coming from the field instrument to be decoupled from the analogue signal lines (4 to 20 mA) and to make them lead together to a bus. This is done by some specific Contrans I modules which receive the FSK signals on the field line and route them to the FSK Bus via a FSK Modem.

One SMART VISION Client may have up to four FSK Bus lines containing up to 100 Contrans I Backplanes, capable of connecting up to 32 HART instruments each. Within the CADEREYTA Project, 16 SMART VISION Clients were used to connect the entire range of the 14 500 devices. The Contrans I Modules are located inside of cabinets. The SMART VISION Clients are located in the same control room.

As it was essential to have access to each device from one single operating station, the 16 SMART VISION Clients were hooked up to a common Ethernet. For this reason, it is possible to remote control each Client and thus each device via one HART Managing Terminal.

In order to ensure maximum data exchange speed via long distances, fibre optic cables were used.

For the device management, library functions are currently being used in order to parameterize, configure and observe each individual device. These library functions are part of the SMART VISION package.

The main advantage of the entire HART Managing Network in conjunction with SMART VISION is that the system can also be used with the FTD/DTM concept, without the need of changing or modifying any part of the hardware.

The FDT (Field Device Tool) technique has been developed by a workgroup attended by representatives of more than 20 major process automation companies. The target was to find a solution (open interface) for instrument configuration and management

by a central system engineering tool, no matter which communication protocol used. The result is a vendor and protocol independent FDT specification defining interfaces on the basis of Internet technologies (ActiveX/COM, XML). With this, instruments can be seamlessly integrated into engineering or stand-alone tools by using a software component, which is called DTM (Device Type Manager).

The DTM is provided by the device vendor, holds the entire information of the instrument and provides means to fully configure, maintain and manage the instrument via a comfortable, standardized graphical interface.

CADEREYTA obtained a sophisticated HART Management Network, capable of configuring and managing all 14 500 field instruments by using SMART VISION.

As the open, vendor independent system was chosen, the system may be extended with additional hardware and/or enhanced managing software (FDT/DTM) at any time without any changes in both, hardware and software.

Wireless

By Dick Caro

Previously, we have considered a trend for wireless to replace wired connections in industrial automation. Except for specific mobile applications, wire replacement does not appear to be imminent. There are too many potential candidates, several of which are almost adequate, and others that are just too premature. Unless some industry group such as the Fieldbus Foundation or ODVA takes a position supported by their sponsoring suppliers, nothing will happen soon.

The current wireless candidates are:

IEEE 802.11a, b, and g	called Wi-Fi
IEEE 802.15.1	called Bluetooth
IEEE 802.15.4	called ZigBee

Each of these is incomplete as defined and has drawbacks for industrial automation applications that might be overcome with additional specifications from a sponsoring organization. ZigBee and 802.11g are almost complete standards, and are not yet widely deployed, although there are major silicon commitments to them.

The biggest disappointment for wireless is the purposefully obfuscated market for 3G telephony. Initially specified for 2.2 Mbps stationary data rate using CDMA by the ITU (International Telecommunications Union) as ITU-2000, progress has been slowed by efforts of the world's major telecommunications carriers seeking to milk life out of their legacy GSM and TDMA networks. At first, the story was to move through a half-step called 2.5G, which is almost complete now. Then they all began to call this "3G" even though it was not. Now to muddy the waters even more, they are talking of waiting until 4G happens - and it is not even defined. For industrial automation, this means that 3G silicon characterized by low power and long distance will not be available any time soon.

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